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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/775,370	02/01/2001	Tammy Zheng	PHA51108A	8675

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EXAMINER

ANDUJAR, LEONARDO

ART UNIT

PAPER NUMBER

2826

DATE MAILED: 08/27/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)
	09/775,370	ZHENG ET AL.
	Examiner	Art Unit
	Leonardo Andújar	2826

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1) Responsive to communication(s) filed on 11 June 2002.

2a) This action is FINAL. 2b) This action is non-final.

3) Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4) Claim(s) 27-37 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5) Claim(s) _____ is/are allowed.

6) Claim(s) 27-37 is/are rejected.

7) Claim(s) _____ is/are objected to.

8) Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9) The specification is objected to by the Examiner.

10) The drawing(s) filed on 11 June 2002 is/are: a) accepted or b) objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11) The proposed drawing correction filed on _____ is: a) approved b) disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12) The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13) Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a) All b) Some * c) None of:

- Certified copies of the priority documents have been received.
- Certified copies of the priority documents have been received in Application No. _____.
- Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14) Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
 a) The translation of the foreign language provisional application has been received.

15) Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) Notice of References Cited (PTO-892)

2) Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____.

4) Interview Summary (PTO-413) Paper No(s) _____.

5) Notice of Informal Patent Application (PTO-152)

6) Other: _____.

DETAILED ACTION

Election/Restrictions

1. Applicant's election without traverse of Group I, claims 27-37 in Paper No. 5 is acknowledged.

Acknowledgment

2. The amendment filed on 06/11/2002, paper no. 7, in response to the Office action mailed on 02/27/2002 has been entered. The present Office action is made with all the suggested amendments being fully considered. Accordingly, pending in this Office action are claims 27-37.

Drawings

3. The proposed drawing correction and/or the proposed substitute sheets of drawings, filed on 06/11/2002 have been approved. A proper drawing correction or corrected drawings are required in reply to the Office action to avoid abandonment of the application. The correction to the drawings will not be held in abeyance.

Specification

4. The title of the invention is not descriptive. A new title is required that is clearly indicative of the invention to which the claims are directed.

Claim Rejections - 35 USC § 112

5. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

6. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

7. Claims 28-32 and 34 are rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

8. In the instant case, the specification fails to disclose a description concerning:

- An interface that is formed when a first portion of a plug is planarized before forming a remaining portion.
- An interface that is formed when a first portion of a plug is subjected to CMP before forming a remaining portion.
- An interface that is formed when a first portion of the plug is etched before forming a remaining plug portion.
- Grain boundaries that are formed at the internal interface between two plug portions formed by separated process.
- Properties of an aluminum plug formed using a continuous deposition process.
- Characteristic of the upper surface of a dielectric layer that was planarized by CMP.

9. Claims 28-30 and 34 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Regarding claims 28-30 and 34, it is not clear

which are the structural limitations or the specific characteristics that does not exhibit the claimed plug or the dielectric layer under specific conditions e.g. CMP.

Claim Rejections - 35 USC § 103

10. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

11. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

12. Claims 27-37 are rejected under 35 U.S.C. 103(a) as being unpatentable over Korman (US 5,959,357) in view of Green et al. (US 4,851,895).

13. Regarding claim 27, Korman (see attachment) shows a semiconductor device comprising:

- A first metal portion 16 over a substrate;
- A dielectric layer 44 above the first metal portion;
- A second metal 42a portion above the dielectric layer;

➤ A single layer plug 42b extending from the first metal portion through the dielectric layer to the second portion.

14. Moreover, the plug has a first upper surface 42c extending laterally beyond the second metal portion and substantially planar to an upper surface of the dielectric layer and a second upper surface 42d that extends above the first upper surface (see attachment). The single layer plug is made of copper (col. 5/ll. 23). However, Korman does not disclose that an aluminum alloy can be used to make the single layer plug. Green discloses the interchangeability between aluminum alloy and copper as metalization materials. Moreover, Green discloses that the metalization materials suitability depend on the material properties such as, e.g. electrical conductivity, electrical contact resistance stability of such electrical properties over time, physical integrity and adhesion, and the availability of a suitable etchant in photolithographic processing (col. 1/lls. 21-30). It would have been obvious to one of ordinary skill in the art at the time the invention was made to make Korman's single layer plug of aluminum alloy because copper and aluminum alloy are interchangeable as taught by Green.

15. In regards to claims 28-32 (as understood), Korman shows that the single layer plug comprises a first and second portion. Korman shows that the single layer plug is a single piece. Therefore, Korman's device does not exhibit any type of interface. Moreover, a "product by process" claim is directed to the product *per se*, no matter how actually made. See In re Thorpe et al., 227 USPQ 964 (CAFC, 1985) and the related case law cited therein which make it clear that it is the final product *per se* which must be determined in a "product by process" claim, and not the patentability of the process,

and that, as here, an old or obvious product produced by a new method is not patentable as a product, whether claimed in "product by process" claims or not. As stated in Thorpe, even though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product itself. *In re Brown*, 459 F.2d 531, 535, 173 USPQ 685, 688 (CCPA 1972); *In re Pilkington*, 411 F.2d 1345, 1348, 162 USPQ 145, 147 (CCPA 1969); *Buono v. Yankee Maid Dress Corp.*, 77 F.2d 274, 279, 26 USPQ 57, 61 (2d. Cir. 1935). Note that Applicant has burden of proof in such cases as the above case law makes clear.

16. Regarding claim 33, Korman shows that the dielectric layer 44 is a single layer dielectric.

17. Regarding claim 34 (as understood), Korman shows that the dielectric layer has an upper surface. Korman does not disclose which process was used to make the dielectric layer. Moreover, a "product by process" claim is directed to the product *per se*, no matter how actually made. See *In re Thorpe et al.*, 227 USPQ 964 (CAFC, 1985) and the related case law cited therein which make it clear that it is the final product *per se* which must be determined in a "product by process" claim, and not the patentability of the process, and that, as here, an old or obvious product produced by a new method is not patentable as a product, whether claimed in "product by process" claims or not. As stated in Thorpe, even though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product itself. *In re Brown*, 459 F.2d 531, 535, 173 USPQ 685, 688 (CCPA 1972); *In re Pilkington*, 411 F.2d 1345, 1348, 162 USPQ 145, 147 (CCPA 1969); *Buono v. Yankee Maid Dress Corp.*, 77

F.2d 274, 279, 26 USPQ 57, 61 (2d. Cir. 1935). Note that Applicant has burden of proof in such cases as the above case law makes clear.

18. Regarding claim 35, Korman shows that the plug does not exhibit a void.
19. Regarding claim 36, Korman shows that the second upper surface of the single layer plug is substantially planar with a second upper surface of the second dielectric layer 44.
20. Regarding claim 37, Korman shows that the portion of the dielectric layer including the second upper surface has a side wall portion SD2 that is substantially aligned with a first side wall portion of the second metal layer SD1, and wherein the portion of the plug including the second surface has a side wall SD3 portion that is substantially aligned with the second side wall portion of the second metal layer SD1.

Response to Arguments

21. Applicants' arguments filed 06/11/2002 have been fully considered but they are not persuasive. Regarding applicants' argument that the limitations of claims 28-32 and 34 are discussed in the example illustrated in figures 2A-2D, it is respectfully noted that this section of the specification does not disclose any subject matter directed to "an interface" which is the subject matter claimed in claims 28-32 and 34.

22. Also, applicants rely on the disclosure of page 3, lines 13-16 and page 10 lines 25-28. However, these sections of the specification do not contain any disclosure regarding "an interface". Applicants claim, *inter alia* "that the plug does not exhibit an interface that would exist, were a first portion of the plug is planarized before a remaining portion of the plug is formed". Nonetheless, the specification does not

contain any description regarding an interface that would exhibit a plug made by one of the recited methods. Also, applicants did not show where in the specification as originally filed is disclosed a description regarding a grain boundary that would exist in a plug formed during separate process, the specific properties that have a plug formed by a continuous depositing process, and/or a description regarding the surface characteristics that would exist in a dielectric layer that have been planarized by CMP. Applicants argue that those characteristics are well known in the art (e.g. grain boundaries and surface conditions). These examples are not considered to be pertinent since these descriptions are generic and inherent to any metal layer. Applicants fail to disclose specific examples.

23. In response to applicants' argument that the cited references fail to teach every single element of the claimed invention, it is respectfully noted that the cited references disclose every single element of the claimed invention. In the instant case, applicants argue that "that the single layer plug 42b appears to be a two layer plug where the lower portion was made before the top portion. However, the attached fig. 3 clearly shows that single layer plug 42b is a single layer. Note that fig. 3 does not show any element that would create a discontinuity between the lower and the top portions. Moreover, only the final product is relevant, not the process of making.

24. In response to applicants' argument that the first upper surface 42c is not substantially planar to an upper surface of the dielectric layer, it is respectfully noted that the attached figure 3 clearly shows that the first upper surface 42c is substantially planar to an upper surface of the dielectric layer 44.

25. In response to applicants' argument that the examiner's conclusion of obviousness is based upon improper hindsight reasoning, it must be recognized that any judgment on obviousness is in a sense necessarily a reconstruction based upon hindsight reasoning. But so long as it takes into account only knowledge which was within the level of ordinary skill at the time the claimed invention was made, and does not include knowledge gleaned only from the applicant's disclosure, such a reconstruction is proper. See *In re McLaughlin*, 443 F.2d 1392, 170 USPQ 209 (CCPA 1971).

26. In response to applicants' argument that there is no motivation for modifying the teachings of Korman with the teachings of Green, it is respectfully noted that Green teaches the interchangeability between metallization materials such as gold, aluminum, aluminum alloys, and copper. Moreover, to use of aluminum instead of copper is within the general skill of a worker in the art since both materials are recognized to be interchangeable. The material selection a matter of design choice. For example, Green discloses that metallization materials suitability depend on the material properties such as, e.g. electrical conductivity, electrical contact resistance stability of such electrical properties over time, physical integrity and adhesion, and the availability of a suitable etchant in photolithographic processing (col. 1/lls. 21-30).

Conclusion

27. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a). A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the

event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

28. Papers related to this application may be submitted directly to Art Unit 2826 by facsimile transmission. Papers should be faxed to Art Unit 2826 via the Art Unit 2826 Fax Center located in Crystal Plaza 4, room 3C23. The faxing of such papers must conform to the notice published in the Official Gazette, 1096 OG 30 (15 November 1989). The Art Unit 2826 Fax Center number is **(703) 308-7722 or -7724**. The Art Unit 2826 Fax Center is to be used only for papers related to Art Unit 2814 applications.

29. Any inquiry concerning this communication or earlier communications from the examiner should be directed to **Leonardo Andújar** at **(703) 308-0080** and between the hours of 9:00 AM to 5:00 PM (Eastern Standard Time) Monday through Friday or by e-mail via Leonardo.Andujar@uspto.gov. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nathan Flynn, can be reached on (703) 308-6601.

30. Any inquiry of a general nature or relating to the status of this application should be directed to the **Group 2800 Receptionist** at **(703) 305-3900**.

31. The following list is the Examiner's field of search for the present Office Action:

Field of Search	Date
U.S. Class / Subclass (es): 257/758, 759 and 760	08/2002
Other Documentation:	
Electronic Database(s): East (USPAT, US PGPUB, JPO, EPO, Derwent, IBM TDB)	08/2002

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